

REARED ASSOCIATION AND EQUIVALENCY OF *BAETIS ADONIS* AND *B. CAELESTIS* (EPHEMEROPTERA: BAETIDAE)¹

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ABSTRACT: The examination of reared larvae and adults of a southwestern North American small minnow mayfly species (Ephemeroptera: Baetidae) belonging to the *rhodani* group of the genus *Baetis* indicates that larvae previously referable to *B. caelestis* are actually *B. adonis*. The species names are synonymized, the adult description of *B. adonis* is expanded, and other data associated with this previously poorly known species are updated.

Moriyama and McCafferty (1979), in their revision of the *Baetis* species of North America, described the distinctive larvae of three species from western North America that they did not name at the time, but designated simply as species A, B, and C. Those authors were reluctant to assign formal names to those distinctive larval forms because numerous *Baetis* species in western North America remained known only as adults, and there was a reasonable chance that the newly discovered larvae were associated with one of those nominal species.

In the absence of any adult association, Allen and Murvosh (1983) applied the name *B. caelestis* Allen and Murvosh to *B. sp. A* Moriyama and McCafferty. Later, Allen and Murvosh (1987) applied the names *B. libos* Allen and Murvosh to *B. sp. B* Moriyama and McCafferty, and *B. notos* Allen and Murvosh to *B. sp. C* Moriyama and McCafferty, both in the absence of adult associations. In the meantime, however, McCafferty and Waltz (1986) had already named *B. sp. B* as *B. magnus* McCafferty and Waltz because they had associated (by time and location, not rearing) distinct adults with the species that were apparently not previously described, thus suggesting the validity of the species. Based on reared materials, Durfee and Kondratieff (1993) were able to provide the first descriptions of the distinctive adults of *B. magnus*, showing that indeed the species was not known under a prior nomen. Durfee and Kondratieff (1995) later also reared *B. notos* and provided a description of the adult. There remains a slight possibility that *B. notos* is a synonym of the prior name *B. caurinus* Edmunds and Allen (which was based only on adults). Adult characterization associated with the latter two names is possibly within an expected range of variation, and *B. caurinus* has yet to be associated with any larvae.

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Baetis sp. A, as *B. caelestis*, has become better known with recent new reports of larvae from Arizona (Lugo-Ortiz and McCafferty 1995), Chihuahua, Mexico (Lugo-Ortiz and McCafferty 1996), New Mexico (McCafferty et al. 1997), and Texas (McCafferty and Davis 1992). However, because larvae were never reared to adult, the question has remained as to whether or not the name would prove to be a synonym.

Recently, eggs taken from Mission Creek, Santa Barbara County, California, were reared to the larval stage identifiable as *B. caelestis*, and also to the adult stage. Examination of those reared adults has indicated, however, that they are referable to *B. adonis* Traver. *Baetis adonis* is a species that has been known only as adults and was originally described by Traver (1935) from material collected in the San Gabriel Mountains of southern California. The only substantiated subsequent report of that species was that of McCafferty et al. (1997) from the Pecos River drainage of eastern New Mexico. Recent examination of alate material on which Day (1963) had based a report of *B. adonis* from Sonoma County in northern California indicated that that material was not referable to *B. adonis*, but probably was *B. diablus* Day.

Morihara and McCafferty (1979) had indicated that the larvae of *B. sp. A* was a member of the *rhodani* species group of *Baetis*, and *B. adonis*, by having the so-called *moffatti* type of genitalia (Traver 1935), would also by definition be placed in the *rhodani* group. Several species besides *B. adonis* were initial candidates for association with *B. sp. A* based on 1) their belonging to the *rhodani* group, 2) being unknown in the larval stage, and 3) being distributed in a reasonable vicinity of southern California. These included *B. palisadi* Mayo, *B. parallelus* Banks, *B. persecutor* McDunnough, *B. piscatoris* Traver, and possibly *B. diablus* Day, *B. sulfurosus* Day, and *B. thermophilus* McDunnough (the species group relationship of the latter three remains in some doubt). *Baetis caurinus* Edmunds and Allen, known only from Oregon and unknown in the larval stage, was easily excluded as a possibility on the basis that it is a member of the *fuscatus* group of species (Edmunds and Allen 1957, Morihara and McCafferty 1979). All others, except *B. adonis* could be excluded on the basis of various characteristics, particularly male genitalia, that were not within the expected range of variation of the characterization expressed by the reared adults under question. The color pattern that Traver (1935) described for *B. adonis* matched well with that of the reared adults. The tone of colors and the body and forewing size did not precisely match, but were within a range of expected variation. Although Traver (1935) did not illustrate or adequately describe the male genitalia of *B. adonis*, identification of reared *B. adonis* from southern California was confirmed by morphological comparisons with type material of that species.

This new association necessitates the following nomenclature adjustment: *Baetis adonis* Traver [= *Baetis caelestis* Allen and Murvosh], **n. syn.** An ad-

equate description of the larvae of *B. adonis* may be found in Morigara and McCafferty (1979:160) as *B. sp. A*, and the basic adult color patterning and hindwing venation is adequately described by Traver (1935:680). The adult description of *B. adonis* is augmented below to include minor variation in size and color traits and a first description of the male genitalia.

Baetis adonis Traver

Material examined. 12 larvae, 55 final-instar larval exuviae, 73 subimagos, 17 male adults, and 12 female adults (all alates reared), California, Santa Barbara County, Mission Creek, VI, VII-1997, E. Silldorff, deposited in the Purdue Entomological Research Collection (PERC). Male adult holotype, allotype, and one male and three female paratypes, California, Los Angeles County, San Gabriel Mountains, VI-3-1932, C. D. Michener, deposited in Cornell University Collection (all type material in alcohol and in very poor condition, with many types broken and deteriorating). One male adult and five female adults, New Mexico, San Miguel County, 5 mi north Pecos, Dalton Fishing Site, VII-13-1969, Koss, McCafferty, Provonsha (PERC).

Male adult. Body length, 5.0-7.0 mm. Forewing length, 5.0-6.5 mm. Base color of head and antennae light reddish brown to medium brown. Dorsal face of turbinate eyes vivid orange, columnar basal area cream (in alcohol). Base color of thorax reddish brown to medium brown to dark olive-brown. Abdominal segments 1-6 ranging from light yellow-brown to medium brown to medium olive brown, varying from pale to intense; segments 7-10 always slightly to considerably darker shade of same colors of segments 1-6, sometimes also appearing opaque. Male genitalia as in Figure 1; base of forceps segment 2 evenly expanding basally and apically into conspicuous more or less symmetrical medially bulbous region, in some bulbous basal area separated from longer narrow portion of forceps segment 2 by somewhat darkened band, or in some entire bulbous basal area of forceps segment 2 darker than remainder of segment; forceps segment 3 relatively short and with demarcation from segment 2 appearing more notched laterally and more fused medially; distal margin between base of forceps segments straight to slightly convex and not notched or emarginate medially.

Distribution. Arizona; Baja California, Mexico; Chihuahua, Mexico; southern California; New Mexico; west Texas.

Remarks. Based on comparisons of male genitalia, it appears that *B. adonis* is related to *B. persecutor*, both of which are very similar with respect to the basal area of forceps segment 2. *Baetis persecutor* is known only from Alberta and British Columbia and remains unknown as larvae. Color patterning in the male adult of *B. persecutor* is quite different than that of *B. adonis*, as is the terminal area of the forceps. The terminal region of the forceps of *B. adonis* is similar to that of *B. diablus*, which is known from the central California coastal area, but otherwise the two species are very distinct.

The mature larvae of *B. adonis* from Santa Barbara are slightly larger than others that have been seen from the Southwest. This may be related to the fact that they were reared for their entire life under ideal laboratory conditions, and were provided with laboratory cultured algae at all times. This slight size increase is possibly reflected in the adult size of approximately 7.0 mm vs. the

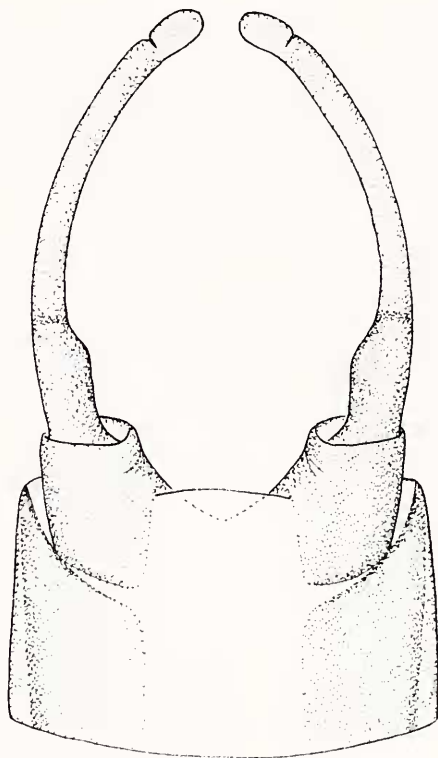


Fig. 1. *Baetis adonis*, male adult, genitalia (ventral view).

5.0 mm of the original type material of this species. We do not know if the predominate olive brown color of the Santa Barbara adults (vs. the yellow-brown of the original material) may also have been related to rearing conditions. Reared females were predominantly reddish brown (quite reddish), and although Traver (1935) described most females of *B. adonis* that she had seen as being yellow-brown or pale reddish brown, she did note that one paratype was wholly reddish brown.

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BOOK REVIEW

SPINELESS WONDERS. STRANGE TALES FROM THE INVERTEBRATE WORLD. Richard Conniff. 1997. Owl Books, Henry Holt & Co. NY. 232 pp. \$12.95 ppbk.

In this small book, nature writer Conniff offers engaging, yet sophisticated discussions on the natural histories of the invertebrate world, from earthworms, leeches, slime eels, and giant squids, to tarantulas, dragon flies, ground beetles, fleas, moths, mosquitoes, house flies, and fire ants.

For each subject, Conniff obtained the advice and counsel of well recognized authorities and further prepared himself by participating in several ongoing, scientific, field research experiences, often in remote, native environments around the world. Thus, in addition to being interestingly and cleverly written, these are scientifically accurate discussions. *Spineless Wonders* takes one directly to the creepy, crawly frontier of natural science, to the hazards of being around invertebrates, to the bizarre adaptations that enable them to survive in this world, and to the astonishing work they do – work that ultimately enables us to survive.

An adequate bibliography is provided. It is unfortunate the publisher did not see fit to provide a cover that does not curl back on itself when not weighted down.

H.P.B.